Declared being a stockholder in Auxogyn Inc.

Renée Reijo Pera
Institute for Stem Cell Biology and Regenerative Medicine
Department of Obstetrics and Gynecology
Stanford University School of Medicine
Stanford, CA, USA

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Non-invasive imaging of human embryos to predict competence

Renee A Reijo Pera

Professor; Institute for Stem Cell Biology and Regenerative Medicine
Department of Obstetrics and Gynecology

Director, Center for Human Embryonic Stem Cell Research and Education
Basic and Translational Research
in Women’s Health@Stanford
Stanford University
I. Introduction to human embryo development

II. Correlating image and molecular data in human embryo development

III. Moving forward: The relationship between image, aneuploidy and epigenetics

IV. Conclusions and future directions

Disclosure: R Reijo Pera is a founder and stockholder of Auxogyn, Inc.
Human Embryo Development and Embryonic Stem Cells

Dobson et al, Hum Mol Genet, 2004; R Reijo Pera, unpublished
Human Embryo Development Frequently Fails and Remains Poorly Understood

- Birth defects
- Chromosomal abnormalities
- Imprinting disorders
- Reproductive failure
- Embryo loss
- Miscarriage
- Multiple Births (IVF)
- Fetal Reduction (IVF)
Imaging and Molecular Analysis of Embryonic Cells

1. Day 1: Thaw 1-cell human embryos
2. Time-lapse imaging on multiple microscopes
3. Day 1-2, Day 3, Day 4, Day 5-6
4. Single embryos
5. Single blastomeres
6. Harvest a mixture of normal and arrested embryos on consecutive days

Wong et al., Nature Biotechnology, 2010
Images, obtained every 5 min over 6 days collated into a movie

Wong et al, submitted
Duration of First Cytokinesis Primary Indicator of Success

Wong et al., Nature Biotechnology, 2010
4 ESSPs of Early Germ Cell Development

Maternal inherited EGA
Blastocyst Ubiquitous

Wong et al., Nature Biotechnology, 2010
Embryo Arrest and Gene Expression in Individual Blastomeres

Wong et al., Nature Biotechnology, 2010
Fundamentals of Human Embryo Development

Wong et al., Nature Biotechnology, 2010
Summary So Far

Human embryonic development is characterized by reprogramming and programming encompassing fusion, epigenetic modification, RNA degradation and gene activation.

Parameters of the first three mitotic divisions prior to embryonic activation indicate success to blastocyst (>93% specificity and sensitivity); thus success/failure inherited (maternal).

Embryos develop cell autonomously with leading and lagging cells by the 8-cell stage.

Defects in underlying molecular programs underlie aberrant blastomere behavior.

Improved diagnostics: Early transfer, fewer embryos, reduced adverse outcomes and increased success.

Next? Relationship of human embryo image with ploidy, epigenetics.
Chromosomal Instability in Cleavage Stage Human Embryos

- Previous studies have demonstrated that aneuploidy is present in a staggering 50-80% of cleavage-stage human embryos.

(Vanneste et al. 2009; Johnson et al. 2010; Picton et al., 2010)
Epigenetic Analysis: Not All Blastomeres Are Alike
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Members of the Reijo Pera Lab, past and present

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....... the end of all our exploring will be to arrive where we started and know the place for the first time.

TS Eliot

Image: S Chavez, unpublished